

## Studies of Nearctic *Rhyacophila* (Trichoptera: Rhyacophilidae): Synopsis of *Rhyacophila nevadensis* Group

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*Abstract.*—Members of the *Rhyacophila nevadensis* group are restricted to a few montane regions of California, Oregon, and Washington. The group contains three species: *R. nevadensis*, *R. vaefes*, and *R. jewetti*. A diagnosis and figures are presented for the males and females of each species. I am not able to separate the larvae of the three species. The larva of *R. vaefes* is described and figured.

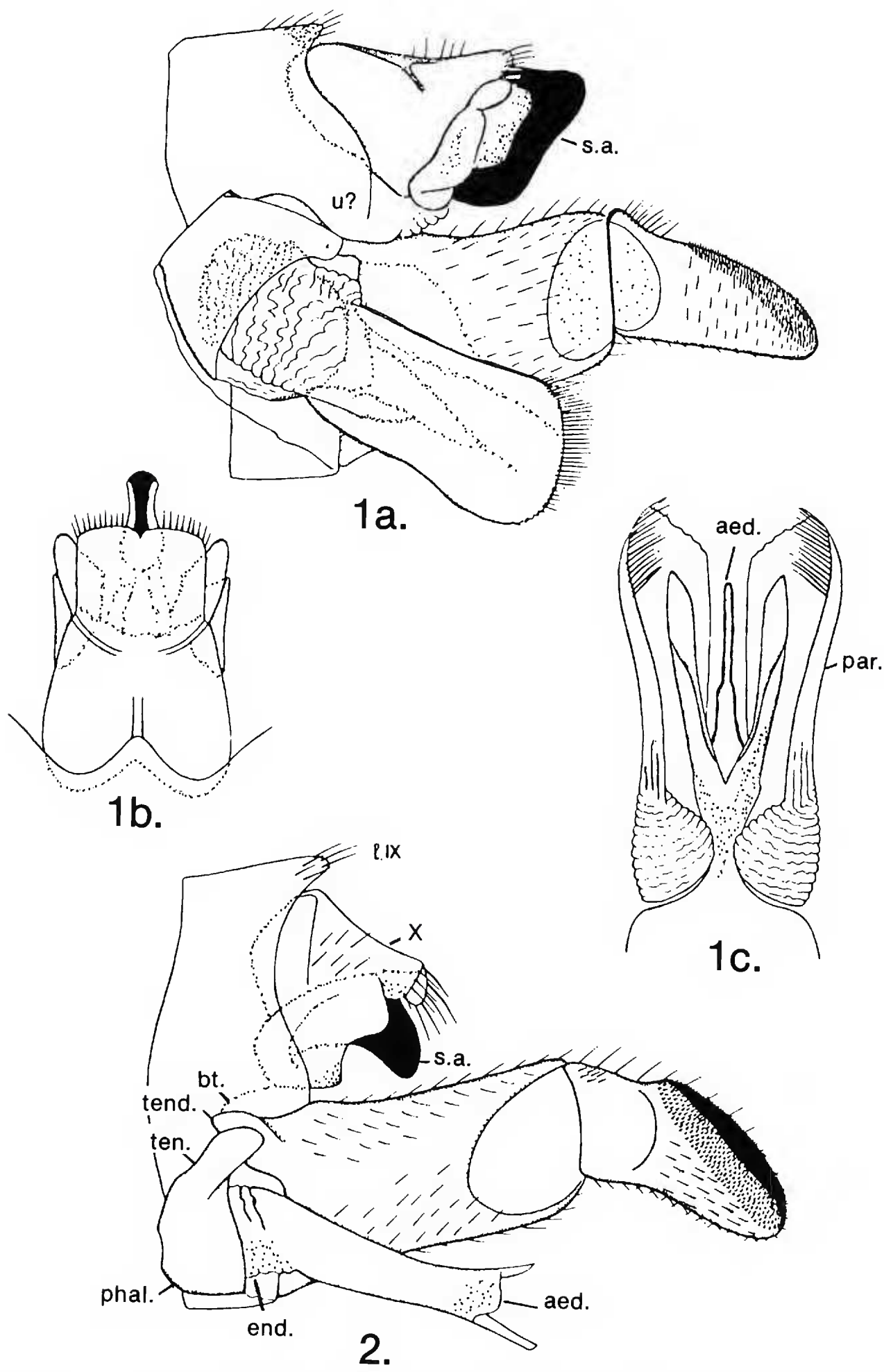
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This is the third in a series of papers to provide figures and descriptions of previously undescribed larvae in species groups of nearctic *Rhyacophila*. Wold (1974) in an extensive but unpublished Master's thesis described the larvae of many species; I have, however, independently established the identity of the larvae that I am describing. Initially I intended to include only larval descriptions. Often, however, as in this paper, it seems appropriate to also include notes on adults.

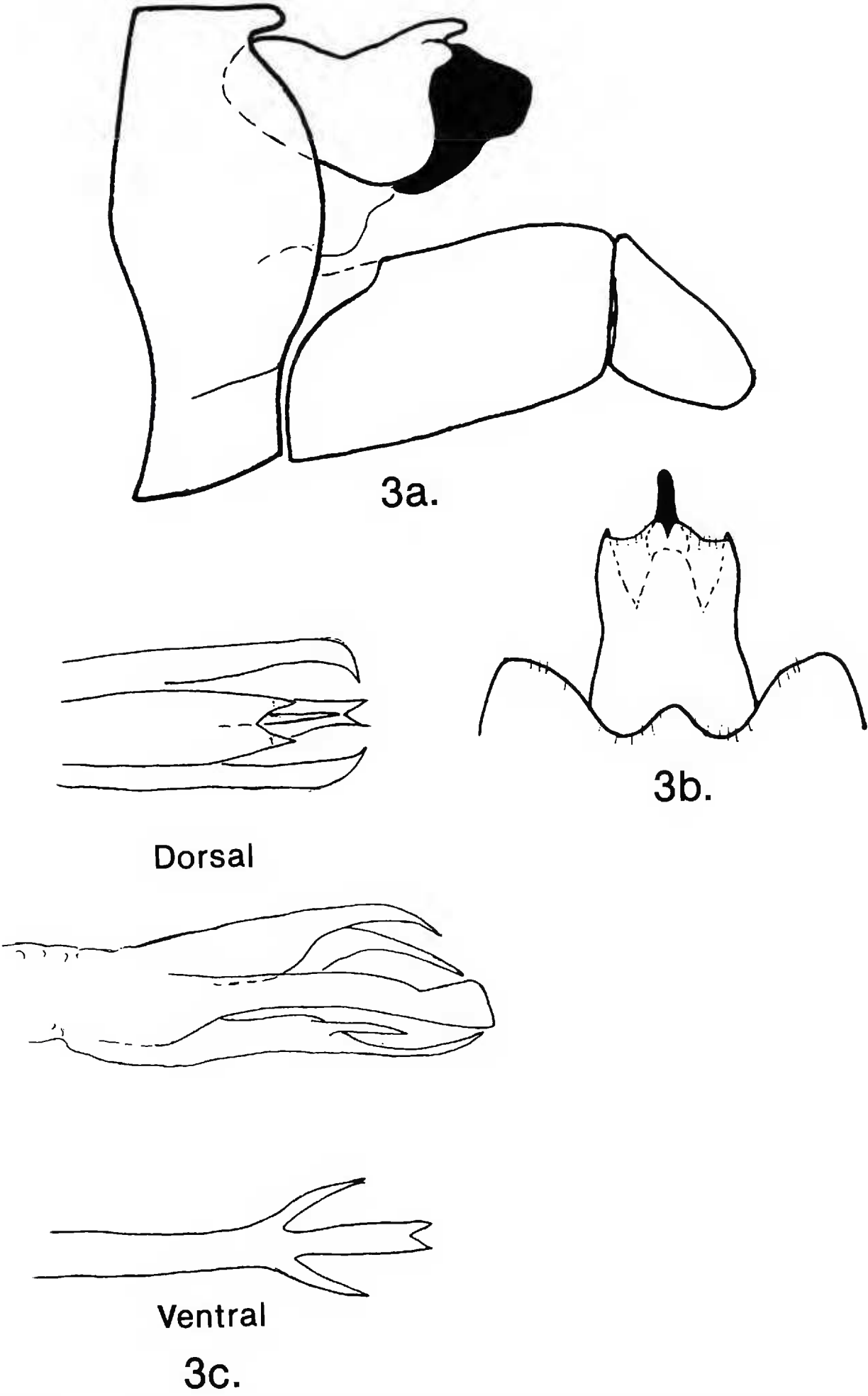
The *Rhyacophila nevadensis* group contains three closely related species that are confined to the Coastal, Cascade and Sierra Nevada mountains of western North America. *Rhyacophila jewetti* Denning is known only from a few locations in Oregon; *R. nevadensis* Banks is recorded from the Sierra Nevada Mountains of California and Nevada and the southernmost peaks of the Cascade Mountains in California, and *R. vaefes* Milne is the most common and widely distributed species and occurs in British Columbia, Washington, and Oregon.

Larvae of *R. vaefes* are most common in slow portions of 1st and 2nd order streams 3 to 10 m wide and less than 1 m deep. Thut (1969) and Wold (1974) discussed some aspects of *R. vaefes* biology. Thut found that *R. vaefes* larvae were omnivorous, "About 40% of the ingested material was plant (particularly diatoms), 40% animal, and the remainder detrital . . . Acari were fed upon in considerable numbers, and Plecoptera nymphs were not fed upon at all." Life history data compiled from records from over the range of *R. vaefes* are confusing; periods of growth probably relate to specific habitat temperature regimes. Adults are found from April to October at different locations throughout its range. Evidence indicates 3rd to 5th instar larvae are the most common overwintering stages. Although they are occasionally abundant, larvae of *R. nevadensis* and *R. jewetti* are infrequently collected and both of the species exhibit rather localized distributions.

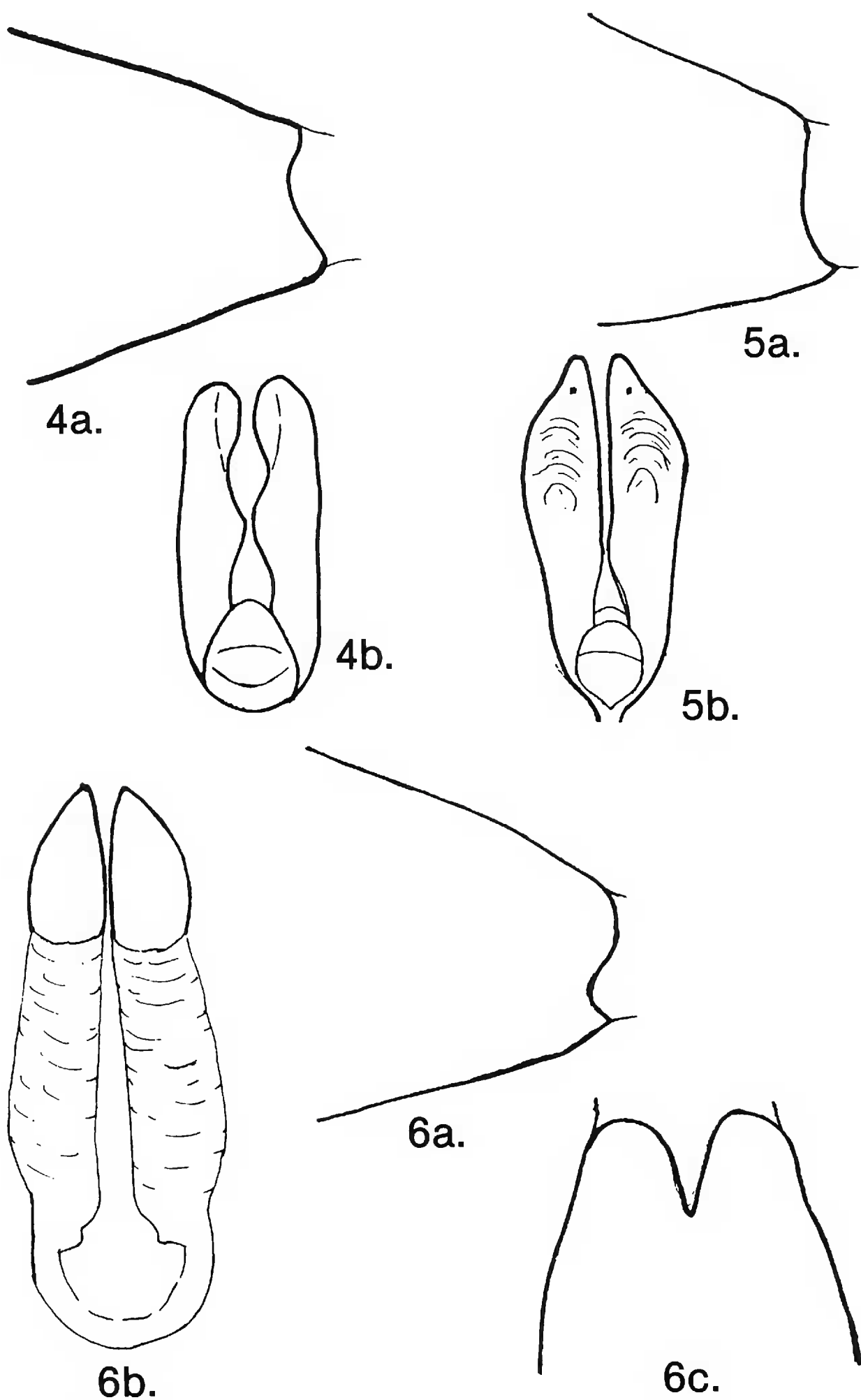
Ross (1956) placed the *nevadensis* group with the Nearctic *vofixa* group, for which the larvae are still unknown, and the Palearctic *tristis* group in branch 2 of his group phylogenetic diagram. He felt that they were rather primitive in nature and had not modified much from the original *Rhyacophila* type and stated, "As it seems to have no known close relatives, the *nevadensis* group appears to



Figures 1, 2. 1. *Rhyacophila vaefes* male; 1a, lateral view; 1b, Xth segment, dorsal view; 1c, phallic apparatus, ventral view. 2. *Rhyacophila nevadensis* male, lateral view. Figures 1 and 2 from Schmid, 1970.



Figures 3–6. 3. *Rhyacophila jewetti* male; 3a, lateral view; 3b, Xth segment, dorsal view; 3c, phallic apparatus. 4. *Rhyacophila vaefes* female; 4a, VIIIth segment, lateral view; 4b, vaginal apparatus. 5.



*Rhyacophila nevadensis* female; 5a, VIIIth segment, lateral view; 5b, vaginal apparatus. 6. *Rhyacophila jewetti* female; 6a, VIIIth segment, lateral view; 6b, vaginal apparatus; 6c, VIIIth segment, dorsal view.

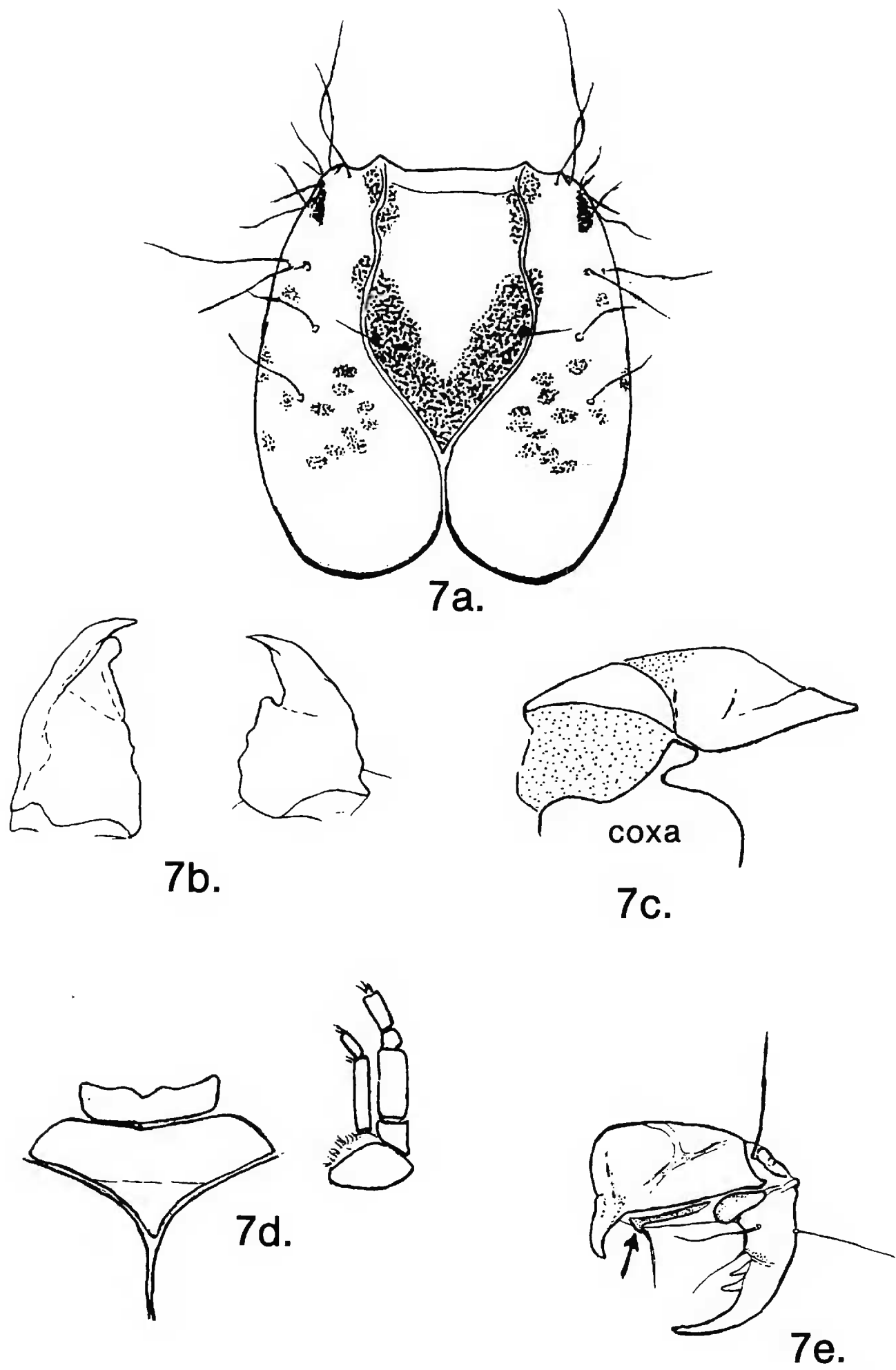


Figure 7. *Rhyacophila vaefes* larva; 7a, head, dorsal view; 7b, mandibles; 7c, propleuron; 7d, submentum and maxillum; 7e, anal proleg.



be another relict group confined to a single series of mountain ranges." Schmid (1970) did not place this group with any assemblage and listed it as having uncertain status. Both Ross and Schmid confined their analyses to adult males. Larvae of the *tristis* group from Europe do not reveal close affinities with those of the *nevadensis* group.

Larvae of the *nevadensis* group do little to clarify their relationships to other assemblages, at least when only Nearctic species are considered. As expected, they exhibit a mixture of apparently plesiomorphic and apomorphic character states. Although it is not my intent to discuss character states and their polarity until later in this series of papers, a few comments relative to the *nevadensis* group are in order here. The anal proleg of the *nevadensis* group is simple and very similar to what I consider the basic rhyacophilan plan, but it does exhibit a modification that is seen in no other Nearctic larvae. This apomorphy is that the small sclerite at the base of the ventral setae (Fig. 7e) is elongated into a distinct sclerite. I have seen larvae from Asia that have a similar but more complex development of this sclerite. The trochantin of the *nevadensis* group is similar to those of several other larval groups and is not produced into a digitate process. I consider the lack of a digitate trochantin to be an apomorphy. The submentum and other maxillo-labial structures seem little modified and most certainly are plesiomorphic. The chaetotaxy likewise gives no clues. Therefore, until we are able to examine larvae of the entire genus, particularly the Asian fauna, the affinities of the *nevadensis* group must remain in doubt. I follow Schmid (1970) and consider it of uncertain status.

#### DIAGNOSIS

##### *R. nevadensis* group

Males are readily recognized by the enlarged anal sclerite (Figs. 1–3), which has a large posterior keel and a flared base. The Xth tergite is simple, surrounding the base of the anal sclerite with a simple lobe on each side. The phallic apparatus is quite different in each of the three species, much more so than would normally be expected in closely related forms of *Rhyacophila*. The phallus varies from most complex in *R. jewetti* (Fig. 3c) with lateral, dorsal and ventral processes to very reduced and fused in *R. nevadensis* (Fig. 2).

Females (Figs. 4a, 5a, 6a) have a rather unmodified VIIIth segment in the shape of a truncated cone with the posterior margin in lateral view roundly concave to quadrately emarginate (in dorsal view the posterior margin is narrowly emarginate in *jewetti* only). The vaginal apparatus (Figs. 4b, 5b, 6b) is composed of two thick lateral pieces and varies from short in *R. vaefes* to elongate and rugose in *R. jewetti*.

Larvae can be immediately separated from all other Nearctic species by the anal proleg. The small sclerite at the base of the ventral seta is greatly developed and extends along the ventral margin of the large lateral sclerite (Fig. 7e). Additionally, larvae have a "paddle" shaped mesal tooth on the left mandible (Fig. 7b). Wold (1974) incompletely described the larva of *R. vaefes*.

##### *R. vaefes* Milne, 1936

*Male*.—In lateral view (Fig. 1) anal sclerite projecting posteriorly well beyond Xth tergite, only base of anal sclerite surrounded by Xth; in dorsal view anal

sclerite with slightly expanded apex. Phallic apparatus with two sets of lateral processes, the outermost large and spatulate.

*Female*.—VIIIth segment (Fig. 4a) more or less a truncate cone, posterior margin roundly concave. Vaginal apparatus (Fig. 4b) sclerotized; lateral pieces with apices evenly rounded, mesal margins sinuate.

*Larva*.—Length mature larva 16 mm. Head (Fig. 7a) slightly longer than wide, widest medially narrowing to the front; cream to light tan colored; dorsum with a dark “V” shaped maculation on frontoclypeus, roughly following the ecdysial line; muscle scars distinct, their number and position variable; venter generally cream colored, darker toward anterior margin, muscle scars indistinct. Mandibles as in Figure 7b, left mandible with a single acute apical tooth and a “paddle” shaped subapical tooth that arises from the anterior part of the mesal blade; right mandible with a single acute apical tooth (occasionally there is also a very small subapical dorsal tooth); apical teeth of mandibles frequently worn and blunt, probably as a result of their somewhat unusual diet. Maxillo-labial structure as in Figure 7d; maxillary palpi with 2nd and 4th segments 1.5 to 2 times longer than 1st and 3rd segments respectively; glossa elongate, cylindrical, normal for genus; submentum separate from ventral apotome, entire, roughly rectangular, anterior margin concave with a median notch.

Thorax without gills. Prothorax with notum cream colored, muscle scars darker, forming an indistinct dark maculation along the posterior half of the ecdysial suture and in the postero-lateral quadrants; posterior margin and posterior half of lateral margins black. Trochantin (Fig. 7c) not produced into a digitate process. Tibial setae 1 and 4 setiform, 1 longer than 4 (setal numbers follow Williams and Wiggins, 1981). All thoracic legs similar.

Abdomen without gills or other specializations. Setae 2, 3, 4, 5 on VIII arise from a common slender sclerite.

Anal proleg (Fig. 7e) simple. Lateral sclerite with a large, curved, slightly acute basoventral hook extending free from membrane; posterior angle not produced into an apicolateral spur; “Y” shaped suture with long stem of “Y” extending from postero-dorsal to antero-ventral angle. Ventral sole plate large; dorsal plate small, produced into two small dorsal protuberances. Ventral seta arising from a narrow, elongate sclerite that lies along the ventral margin of the lateral sclerite. Anal claw with 2 ventral teeth, posterior tooth larger than anterior tooth.

#### ***R. nevadensis* Banks, 1914**

*Male*.—In lateral view (Fig. 2) most of anal sclerite enclosed by Xth tergite, only the tip exposed. Phallic apparatus with lateral processes fused into a tube which surrounds the phallus and appears attached to it ventrally.

*Female*.—VIIIth segment a truncate cone (Fig. 5a) similar to *vaefes*; in lateral view posterior margin slightly concave, postero-ventral angle produced. Vaginal apparatus (Fig. 5b) lightly sclerotized; lateral pieces with apices narrowly rounded, mesal margins straight.

*Larva*.—Same as *R. vaefes*.

#### ***R. jewetti* Denning, 1954**

*Male*.—Most of genitalia (Fig. 3) similar to *R. vaefes*. Anal sclerite very similar to *R. vaefes*, in dorsal view anal sclerite not expanded at apex. Phallic apparatus

with lateral, dorsal, and ventral processes; dorsal process furcate at apex (Fig. 3c); ventral process bearing a large spine on either side subapically.

*Female*.—VIIIth segment (Fig. 6a) more or less a truncate cone as in *R. vaefes* and *R. nevadensis*; in lateral view posterior margin with a sinuate emargination, postero-ventral angle acute; in dorsal view posterior margin with a deep, narrow emargination (Fig. 6c). Vaginal apparatus (Fig. 6b) elongate, posterior quarter sclerotized remainder membranous; lateral pieces with apices pointed, mesal margins nearly straight.

*Larva*.—Same as *R. vaefes*.

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